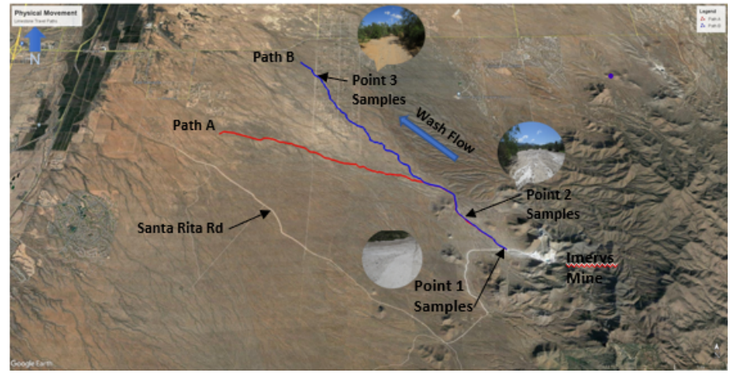
Orthographic Study Summary Limestone Dispersion



Methodology:
The Imerys quarry's limestone was used as an indicator of sediment transport. Using google imagery, the water flow was followed through the wash by using color to distinguish where the water transported the limestone, either by depositing silt as precipitate or by sediment transport. The path began at the highest contaminated area wash, 0.5 miles away from the Imerys quarry. The wash came to a fork and two paths were followed, Path A and B (Fig. 1). At about 8 river miles, the color of the imagery was similar to the colors in the surrounding washes at both paths, evidence that the limestone had not reached those points. Ground investigations were completed, and three (3) samples were chosen through Path B to provide evidence of the flow pattern and evaluated microscopically. At each sample point two (2) specimens were taken, a "Loose Sand Sample" and a "Compacted Soil/Solid Sample". The "Loose Sand Sample" was taken to investigate the distance the limestone powder travels through suspension in stormwater flow. The "Compacted Soil/Solid Sample" was taken to investigate the travel distance of soluble calcium carbonate as it precipitates and is deposited downstream. Below are the results of the investigation.

Imerys Quarry

Point 1 Sample

Sample 1 taken at the contaminated wash.

Point 2 Sample

Sporadic deposits in the wash looking Southeast at Sample 2.

Point 3 Sample

Dark area depicting typical wash color as Sample 3.

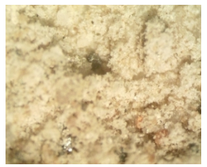
Santa Cruz River

0.5 road mi | 2.0 river mi downstream | 7.4 river mi downstream | Approx. 37 river mi

Loose Sand Sample

Description:
Loose solid Calcite crystals, white powdery, easily dispersed.

Lithology	Limestone, Marble, Calcite
Cement	Weak Calcitic
Grain size	Silt-CG (pebble)
Sorting	Poor
Color	White
Rounding	Angular



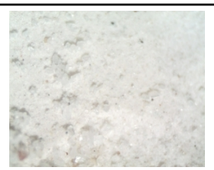
Description:
Coarser sand with few Calcite crystals, tan in color and denser than Point 1 sample.

Lithology	Poly-metic, however dominantly calcitic (limestone)
Cement	Local weakly calcite cemented clumps
Grain size	Silt-vfg (mg)
Sorting	Good
Color	Tan
Rounding	Subangular to subrounded

Description:
Loose sand with various sediments, darker in color as compared to the other samples.

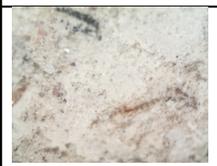
Lithology	Poly-mictic, quartz, feldspar, mafic clasts, granitic fragments, no limestone or calcite grains observed.
Cement	None
Grain size	fg-cg (pebble)
Sorting	Moderate
Color	Brown
Rounding	Subangular to subrounded

Compacted Soil/Solid Sample



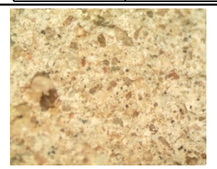
Description:
Soft rock solid smooth textured, white with encapsulated crystals.

Lithology	Limestone, Marble, Calcite
Cement	Local weak Calcitic
Grain size	Silt-vfg; vcg-grav
Sorting	Bimodal
Color	White
Rounding	Angular, euhedral calcite crystals



Description:
Soft, solid other wash sediments; cementing with color has darker tint.

Lithology	Poly-mictic, however dominantly calcitic (limestone)
Cement	Local weakly calcite cemented clumps
Grain size	Silt-cg (gravel)
Sorting	Poor
Color	Tan
Rounding	Subangular to subrounded

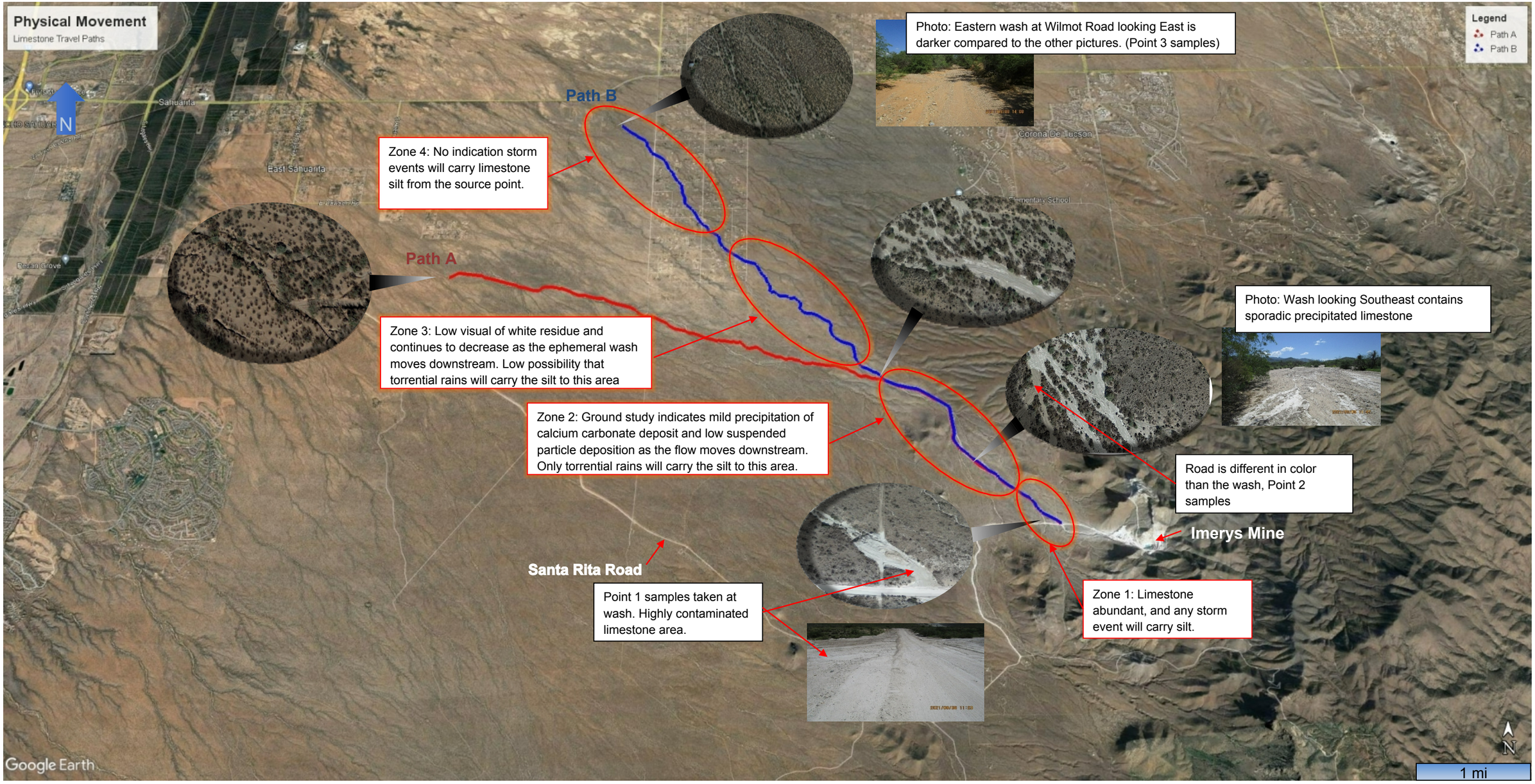


Description:
Soft mud like solid with no encapsulated Calcite crystals. Darker color than other samples.

Lithology	As above including friable clumps with calcitic cement
Cement	Mud like hardened clumps
Grain size	fg-cg (pebble)
Sorting	Moderate
Color	Brown
Rounding	Subangular to subrounded

Conclusion	Limestone is prevalent in this area based on evidence (white color, photos, samples). Both suspended and soluble limestone is found in abondance thus, any storm event would carry the limestone downgradient.	There is sporadic evidence of calcite precipitation with cementing sand grains which indicates a decrease of limestone. The investigation concludes that only larger storm events in the last 50 years would be able to carry the limestone from point 1 to point 2.	Color is very indicative that there is no presence of limestone as the wash is the same color as the surrounding areas. This area has none of the characteristics of pure limestone and rain events would not carry the source limestone to this point.

Conclusion:
Since the limestone's signature decreases as the wash moves downgradient from the source point and there was no evidence of Imerys' contaminant at about 8 miles, then it can be concluded that at the Santa Cruz River (37 river miles) there will be no contaminants from the source point limestone.; neither suspended nor soluble. Therefore, sediment fugitives from the Project will not make it to the Santa Cruz river or to any traditionally navigable water.


Physical Movement
Limestone Travel Paths
Legend
Path A
Path B
N
Path B
Path A
Photo: Eastern wash at Wilmot Road looking East is darker compared to the other pictures. (Point 3 samples)
Zone 4: No indication storm events will carry limestone silt from the source point.
Zone 3: Low visual of white residue and continues to decrease as the ephemeral wash moves downstream. Low possibility that torrential rains will carry the silt to this area
Zone 2: Ground study indicates mild precipitation of calcium carbonate deposit and low suspended particle deposition as the flow moves downstream. Only torrential rains will carry the silt to this area.
Photo: Wash looking Southeast contains sporadic precipitated limestone
Road is different in color than the wash, Point 2 samples
Imerys Mine
Zone 1: Limestone abundant, and any storm event will carry silt.
Santa Rita Road
Point 1 samples taken at wash. Highly contaminated limestone area.
Corona De Tucson
Sahuarita
East Sahuarita
Pecan Grove
Google Earth
1 mi